

Open Access to Scientific Information: A Review of Initiatives

Tarveen Jandoo and Vedamurthy A.B.

The Oxford College of Science, Bengaluru-560 102
E-mail: vedamurthy15@gmail.com

ABSTRACT

Open access journals are the one's which are available online to the reader without financial, legal, or technical barriers other than those inseparable from gaining access to the internet. Some of the scholarly journals are subsidised, and some require payment. However, a number of challenges remain, such as high and rising subscription prices to scientific publications, an ever-growing volume of scientific data, and the need to select, curate, and preserve research outputs. Open access benefits researchers, innovators, teachers, students, media professionals, and the general public. It promotes global knowledge flow for the benefit of scientific discovery, innovation, and socio-economic development.

Keywords: Author, scholarly journals, scientific information, open access

1. INTRODUCTION

Access to scientific information is undergoing a fast transition. What was earlier procured by arduous efforts is now available for open access (OA). Not only synthesis but also the dissemination and sharing of knowledge are gaining importance. Besides the academic intent, business goals are making OA a favoured mean to disseminate research findings. The OA refers to reaching for electronic forms of the articles. The OA essentially means availability of scientific or scholarly research literature for free access to all on the web as free online journals and institutional repositories (IRs).

The BioMed Central has veritably described OA as the writing being universally and freely accessible via the Internet in an easily readable format and deposited immediately upon publication without embargo in agreed format in at least one widely and internationally recognised freely accessible repository¹.

The primary methods of achieving OA are publication in OA journals, deposition of copies of articles in OA archives or repositories (self-archiving), or a combination of the two. These two means of OA are referred to as the 'Gold' (publish in an OA journals) and 'Green Roads' to OA (publish in a non-OA journals but archive in an OA archives), respectively². The OA plays a huge role to cultivate literacy and spread awareness.

2. TYPES OF OPEN ACCESS ARCHIVES AND JOURNALS

The OA is typically divided into profit and non-profit segments. The latter includes the university press, archives, scholarly societies, etc. The former comprises the corporate sector. This sector offers a wide range of online journal access service with sophisticated indexing.

The best examples from the corporate sector are the major players like Reed Elsevier, Kluwer, Springer, and Wiley. More are increasingly being added to the list. Reed Elsevier's *Science Direct* is a proven wealth of 1,500 of its scientific, technical, and medical journals. Similarly, *Ingenta* serves around 200 publishers. This integration of scholarly resources has profited, in part, from increasing corporate concentration within academic publishing. *Crossref* which currently involves 6,809 journals and 5.1 million records from 147 journal publishers, is a collaborative reference linking service that enables the readers to move from a bibliographic entry of an article to the work cited. This has made reference searching and citing an interesting online activity. Scholarly society is benefitted by this ability to easily move from reference to reference in around 7000 journals.

Other examples of OA indexing are open access indexing services, computer corporation NEC's *Research Index* in the sciences, the National Library of Medicine's

PubMed in the life sciences, and the National Library of Education's *ERIC* in education. Highwire Press being operated by Stanford University library is a leader in electronic journal publishing in sciences and medicine. It has a huge repository of free articles. 125 of the 336 electronic journals it publishes offer free access to back issues, while 15 journals offer complete OA³.

3. VALUE AND VIABILITY OF OPEN ACCESS JOURNALS

The OA is thoroughly digital and non-commercial. With support from grants, scholarly associations, institutional support or author fees, OA publishing utilises the reduced costs of publishing in electronic formats alone to make journals and other online research resources free to read. This has enabled easy, fast and open sharing of scientific work. In some cases, this approach however, has been viewed as a rebel against inflated subscription costs for journals³.

The scholarly associations that have dominated scientific journal publishing are faced with a new challenge with the emergence of digital publishing. These associations account for the majority of researchers, reviewers, and editors engaged in their efforts to advance the state of scholarship and research. With changing trends, many scholarly associations have turned their journals over to commercial publishers. Some offer complete or partial open access to their publications. For example, National Council of Teachers of English provides access to *Research in the Teaching of English*, *College English*, and its other journals, one year after publication; and the Institute of Physics provides free access to its journals for 30 days from the date of their publication³.

These associations are now concerned as to how to preserve their membership rolls at a time of declining memberships across the society. The journal subscriptions have been a principal benefit of membership to these associations³.

4. AUTHOR EXPECTATIONS IN DIGITAL PUBLICATIONS

As with print journals, digital versions are increasingly being recognised as identity of scholarly achievement⁴. The OA can enable maintenance of independent journals clearly supporting the scholarly stature. Low barriers to entry are encouraging the emergence of independent journals. This has been identified by the American Association for the Advancement of Science report on scholarly publishing⁵.

Publications have been traditionally described as work for scholarly and scientific purposes, meeting the quality standards of peer review, hence qualifying in acceptance for publication by a peer-reviewed journal⁶.

Harnad has further remarked that making one's publication accessible is not the same as scholarly publishing, thus emphasising how interests of authors are much beyond providing free access to their work.

Authors have a quest to understand the publisher's role. Publishers create journals after market research for needs. They develop online systems, manage peer review and market the journal. Besides this, they offer content editing, customer service, and archiving. Authors expect to contribute to peer review as their duty to discipline⁷. The OA should be able to comply with these functions to be accepted by writers and researchers.

Copyrights have been a prime concern for authors submitting writings and research work on OA. The copyrights should clearly rest with the authors who conceive and own the writing. Authors should have control over the integrity of their work and the right to be properly acknowledged and cited^{8,9}. Self publishing and self archiving are being enabled by OA. Self-archiving pre-refereeing preprints, is an excellent way of establishing priority and asserting copyright. Authors should feel convinced about the universal global good that the OA to journals is sure to offer. In the interest of learning, there will be more availability of resources. Free access is bound to hold scholarly intent in high esteem. They should be satisfied that the primary mission of creating, sharing, and disseminating knowledge is being met¹⁰.

5. COST ISSUES AND FINANCIAL IMPLICATIONS OF OA PUBLISHING

The OA is not devoid of costs. Publication of the article in a journal is only one part of the cost of research communication; first of all there are the costs of research and writing, then the costs of peer review, editing and publication, and finally the costs of acquisition by the library, management, storage, reading by the end user and long-term preservation⁷.

Research leading to the writing of the paper accounts for around 90 per cent of the total cost. This is largely financed by public bodies. The costs of preparing, reviewing, distributing, archiving and retrieving scientific articles are borne by universities and public libraries. The journal publishers incur a small fraction of the total lifecycle cost. Their commercial interests have made access to these publications highly restrictive and expensive.

Electronic versions available to subscribers only have defeated the very motive of using internet to allow easy access. It is in legitimate interest of the researchers and the public to have this kind of information published for free on the internet. Global access and hyperlinking of research publications can facilitate the dispersion of information and knowledge¹¹.

Commercial concerns have been rising in the past decades. In 1960, the 300 economic journals of the time were almost entirely non-profit, while by 1980, half of the then 120 journals were published by commercial concerns, and by 2000, that proportion had risen to two-third of the 300 journals¹². This has been viewed with concerns that it may dwarf the scholarly interests.

The price of academic journals has increased by large amounts and libraries and individuals are struggling to come up with the money to pay for information that is essential for scholarly investigation. The electronic forms of OA are a means to cut huge costs from the publishing system, and by embedding the new OA regime primarily in the non-profit sector, OA can return exorbitant profits back to the research community.

The publishers have introduced brand journals which are sold as electronic versions at prices which do not differ much from the subscriptions to the paper versions. In dealing with digital information they can effectively use all sorts of strategies typical for e-commerce with information goods, such as bundling and differential pricing¹³. The debate is still viable if digital publishing offers savings¹⁴.

There are varying opinions on the cost of web publishing^{15,16}. In selfish commercial interests, publishers are said to claim that web publishing is almost as expensive as ordinary paper-based publishing. They are said to be trying to justify the increasingly expensive subscriptions. On the contrary, advocates of free publishing claim costs to be lower in this practice.

The cost analysis of web publishing may perhaps need to be reviewed keeping in concern the whole lifecycle cost of a scientific paper in the analysis. Calculated through this approach, cost borne by publishers are of the magnitude of 3-5 %¹⁷. However, the copyrights for services rests with the publishers. This differential in cost and copyrights needs to be addressed.

6. SCIENTIFIC PUBLICATION LIFE-CYCLE MODEL AND OTHER MODELS-BRIEF

The 'Scientific Publication Life-Cycle Model' presents the life cycle of a single refereed journal publication from the research leading to it and writing it into it being read by other researchers years later or used as an inclination for practical implementation.

The SciX (O\open, self organising repository for scientific information exchange) project has developed cost and time efficient internet enabled business models (using graphical modelling language called IDEF0) for scientific publishing¹⁸. The unit of observation chosen in the model is the single publication. This model elaborates the trends of how a publication is written, edited, printed,

distributed, archived, retrieved, and read, and how eventually it may affect practice. The focus is on life-cycle cost per publication. The model has an objective of trying to optimise the total life-cycle costs, rather than the cost of some particular stage through reengineering efforts. Usefulness of such models rests in their application in cost studies and their potential utility as a road map in different OA initiatives.

Federated Initiative of GAP and Roquade (FIGARO) is a joint initiative of two Dutch and two European universities to set up an infrastructure for academic e-publishing in Europe and to establish a network of content providers making use of this infrastructure¹⁹. One of the major objectives of this model is to help realise business process innovation through the establishment of a collaborative business model for e-publishing within a virtual community of academic institutions and small and medium-sized enterprises (SMEs). This model supports journals, publication sites with or without peer reviewing (peer reviewing may take place before or after publication); institutional repositories and other forms of open archives; co-publishing with traditional publishers, producing the electronic version of a journal which is already published in print. This explains the usefulness of the model.

7. NEW INITIATIVES IN SCHOLARLY PUBLISHING

Scientific publication practices attract attention as scientists derive their identity and stature from the reputation of the journal to which they contribute. 'Publish or perish' has become the adage to support the strong proclivity of scientists to share their work and interests. Though the desire to share and communicate in scientific content is not esoteric, few have been anxious enough to explore new initiatives in scholarly publications. Fastidious practises of publication in paper print mode are still dominant.

A small section of the scholarly community have supported the new methods of scientific publications like preprint repositories, OA scholarly journals and journals offering a review process.

Archives, in both preprint and reprint forms, can be useful reserves. Individuals can publish their work on their personal home pages. These are called personal archives²⁰. Universities and institutions can collect, preserve and provide access to the scientific output of their institute to build an 'institutional repository'²¹. These practices put together can provide a worldwide network of servers providing free full-texts.

Some transformations, likely in near future, include the publication of articles as soon as they are ready to be shared. This will drive the concept of journal issues to become obsolete. Research data when published online

can be appended according to need for the same. The publication can be enriched by multimedia²². These together can add a new dimension to publishing.

8. INSTITUTIONAL ARCHIVES AND REPOSITORIES

The institutional repository (IR) is a university-based digital-asset management system¹⁰. The IR present a rather different picture from current OA journals and subject-specific repositories. University libraries have considerable funds at their disposal and are used to outsourcing part of the work in building their information technology infrastructure. They also take a long-term perspective in the setting up of IR. For instance, already in the planning stages, they need to take into account the periodic necessity to upgrade the storage media and the storage formats. In addition to scientific publications universities also have a need to systematically organise the web-based educational material produced by the faculty¹¹.

IR or the OA archive has been described as the most cost-effective and immediate route to providing maximal access to the results of publicly funded research, thereby maximising the potential research impact of these publications^{20,23,24}. Additionally, these have been considered means to expand on the amount and diversity of scholarly material that is collected and preserved, thus enhancing teaching, learning, and research at the host institution and beyond²⁵. The IRs have added dignity and repute to institutions that showcase the faculty's research output²⁶. Lastly, IRs have been recognised as an essential infrastructure for the reform of the entire enterprise of scholarly communication and publishing²⁷.

9. BENEFITS AND CHALLENGES IN OA PUBLISHING

Besides the advantage of a free access, OA offers advantages of increased research impact and easier affordability. The latter has helped to address the serial crisis, where the high cost of subscriptions has caused many libraries to reduce the number of serials in their collection^{28,29}. Research impact is measured by citations or downloads and this is undoubtedly increased due to OA^{30,31}. Online access to publications enables alerts through various modalities that some new publication is now available. E-mail alerts are the best and most commonly used methods for this.

Digital sharing has proved to be a caveat to traditional publishers and has even evolved to be a threat. The internet earlier qualified as the first resource for getting scientific information³², has increasingly become the sole resource. More so it is now a favoured choice in young researchers. Björk and Turk have studied the scientists' preferences in the scholarly community and construe that

scientists prefer downloading papers from the web to walking over to a library. They have been seen to favour the resources that are freely available, without and with subscription charges. The *ScienceDirect* is a manoeuvre of traditional publishers that allows pay-on-demand access to the full-texts of published papers³³.

As more and more universities start planning for repository systems they are likely to look for and explore newer options like planning for joint national collaboration platforms, using well-proven open source applications, buying the software from outside information technology consultants and outsourcing the whole service to commercial publishers. These issues will require planning and controlled implementation¹¹.

There are a number of challenges in the present developments in academic publishing. These include the innovative use of technology; restoration of the primacy of communication; development of new measures for the impact of a publication in the academic community; and development of new business models, aiming at open access²². There are many more psychological, legal and institutional barriers to adopt the change in the process of publication. These have not got a welcome response from many erudite intellectuals.

10. CONCLUSIONS

The OA is the future. It should be supported and utilised in best practices for benefit of all. Publishing for e-journals can prove to benefit the scholarly associations. This can be made possible by the savings realised by dropping the print editions, direct forms of support provided by research libraries, charging author fees and institutional memberships, or a combination of these methods³.

Validated models to investigate the process and impact of studying web publishing should be developed after consultation with scientific experts, librarians and publishers. These models should be itemised to provide a basis of cost analysis of this process to further facilitate development of methods to curtail costs currently involved in access to scientific literature on web. Reader behaviour and economies of OA will need to be reiterated. The overall process of scholarly communication is yet capable of a huge significant transformation.

An unaddressed issue is to determine whether the cost of producing a free Internet based peer reviewed journal is substantially lower than for a traditional paper based one. Research in this domain is desirable. Issues like type, content, and quality of writing influence cost. Research for cost analysis in light of these parameters is meagre. A poor article costs the system much more overall than does a good one. Nobody really knows yet the cost of preserving electronic journals⁷. The answer to

this question could be a major parameter for determining whether the public authorities financing research and library activities should start financing free scientific publishing efforts, for instance using a business model where a hub for running several refereed journals and or e-prints archives is offering its services for free for non-commercial use.

The authorities could also change their attitude towards the researchers that they fund surrendering their copyright rather unconditionally to commercial publishers. Innovative use and application of technology will eventually enable 'global mapping of science'²².

REFERENCES

1. Velterop, J. Open access: All use is fair use. *In* First Nordic Conference on Scholarly Communication, Lund, 2002.
2. Harnad, S.; Brody, B.; Vallières, F.; Carr L. & Hitchcock, S. The access/impact problem and the green and gold roads to open access. *Serials Review*, 2004, **30**(4), 310-14.
3. Willinsky, J. Scholarly associations and the economic viability of open access publishing. *Open J. Sys. Demon. J.*, 2005, **1**(1).
4. Lawrence, S. Free online availability substantially increases a paper's impact. *Nature Web Debates*, 2001.
5. Frankel, M.S. Seizing the moment: Scientists authorship rights in the digital age. Report of Study by American Association for the Advancement of Science, Washington, DC, 2002.
6. Harnad, Stevan. Online archives for peer-reviewed journal publications. *In* International Encyclopedia of Library and Information, edited by J. Feather & P. Sturges. Routledge, London, 2003. [http://www.cs.soton.ac.uk/%7Eharnad/Temp/archive s.htm](http://www.cs.soton.ac.uk/%7Eharnad/Temp/archive%20s.htm)
7. Morris, S. The true costs of scholarly journal publishing. *Learned Publishing*, 2005, **18**, 115-26.
8. Davis, T. License agreements in lieu of copyright: Are we signing away our rights? *Lib. Acq.: Pract. & Theo.*, 1997, **21**(1), 19-28.
9. Muir, A. Copyright and licensing for digital preservation. *Lib. Inf. Update*, 2003, **2**(6), 34-6.
10. Chan, L. Supporting and enhancing scholarship in the digital age: The role of open-access institutional repositories. *Canadian J. Commu.*, 2004, **29**, 277-300.
11. Björk, B.C. & Hedlund, T. Scientific publication life cycle model (SPLC). *In* From Information to Knowledge: Proceedings of 7th ICC/IFIP International Conference on Electronic Publishing, edited by S.M. de S. Costa; J.Á. Carvalho; A.A. Baptista & A.C.S. Moreira, Universidade do Minho, Portugal, 2003.
12. Bergstrom, T.C. Free labor for costly journals. *J. Econo. Pers.*, 2001, **15**(4), 183-98.
13. Shapiro, C. & Varian, H. Information rules-A strategic guide to the network economy. Harvard Business School Press, Boston, 1999.
14. Fisher, J.H. Comparing electronic journals to print journals: Are there savings? *In* Technology and Scholarly Communication: The Institutional Context, edited by Richard Ekman & Richard E. Quandt, University of California Press, Berkeley, 1999. pp. 95-101.
15. Odlyzko, A. The economics of electronic journals. *J. Electr. Publ.*, 1998, **4**(1).
16. Tenopir, C. & King, D. Towards electronic journals, realities for scientists, librarians, and publishers. Special Libraries Association, Washington, DC, 2000.
17. Björk, B.C. & Turk, Z. How do researchers find and retrieve scientific publications—A case study of the impact of the internet on the construction IT and construction management research communities. *Electr. J. Inf. Technol. Constr.*, 2000a, **5**(5).
18. IDEF0. Integration definition for function modelling (IDEF0). Federal Information Processing Standards Publication, 1993, 183 p.
19. Grygierczyk, N. & Savenije, B. The Roquade project: An infrastructure for new models of academic publishing. *In* In the Digital Publishing Odyssey: Proceedings of ICC/IFIP Electronic Publishing'01-2001, edited by A. Huebler, P. Linde & J.W.T. Smith, 2001.
20. Harnad, S. For whom the gate tolls? How and why to free the refereed research literature online through author/institution self-archiving, now. *In* Workshop on Open Archive Initiative and Peer Review Journals in Europe, Geneva, 2001.
21. SPARC. The case for institutional repositories: A SPARC position paper. SPARC, Washington, 2002.
22. Savenije, B. & Smith, J. Towards new models in academic publishing. *In* Proceedings of 11th Bobcatsss Symposium: Information Policy and the European Union. Hogeschool van Amsterdam, Nicolaus Copernicus University Torun, Poland, 2003.

23. Harnad, Stevan & Carr, Leslie. Integrating, navigating, and analysing open eprint archives through open citation linking (the opcit project). *Current Science*, 2000, **79**(5), 629-38.
24. Harnad, Stevan. The self-archiving initiative. *Nature*, 2001b, **410**, 1024-025.
25. McCord, A. Institutional repositories: Enhancing teaching, learning, and research. EDUCAUSE: Evolving Technologies Committee white paper, 2003.
26. Crow, Raym. The case for institutional repositories: A SPARC position paper, 2002.
27. Guédon J. Open access archives: From scientific plutocracy to the republic of science. *IFLA Journal*, 2003, **29**(2), 129-39.
28. Mobley, E.R. Ruminations on the sci-tech serials crisis. *Issues Sci. Technol. Lib.*, 1998, **20**(Fall).
29. Parks, R.P. The Faustian grip of academic publishing. *J. Econo. Method*, 2002, **9**(3), 317-35.
30. Lawrence, S. Online or invisible? *Nature*, 2001, **411**(6837), 521.
31. Antelman, K. Do open access articles have a greater research impact? *Coll. Res. Lib.*, 2004, **65**, 372-82.
32. Björk, B. & Turk, Z. How scientists retrieve publications: An empirical study of how the internet is overtaking paper media. *J. Electr. Publ.*, 2000, **6**(2).
33. Björk, T.Z.; Bob, B.M. & Etiel, P. The new role of professional organisations in the management of scientific knowledge. In Conference Proceedings of International Council for Research and Innovation in Building and Construction, 2002.

About the Authors

Dr Tarveen Jandoo is currently associated with Novartis Healthcare Pvt. Ltd. as a Principal Scientific Writer. She holds MD in Pharmacology and is a certified Medical publication professional. She also holds certifications in marketing, project management, and e learning. She has over 10 years cross-functional experience in medical writing and communications, research, academics, clinical practice, medical operations, medico-marketing, market intelligence, analytics, and administration. Her interests include writing, editing, and reading.

Dr Vedamurthy A.B. is currently working as Director of Postgraduate Studies and Professor & Head, Department of Biotechnology at The Oxford College of Science, Bangalore. He holds PhD degree in Biotechnology from Gulbarga University Gulbarga. He has more than 13 years of teaching and research experience. He published around 25 research papers in national and international research journals and conferences proceedings. He has guided one PhD and around 30 MPhil students. His research areas are isolation, purification, characterisation of specific animal/plant proteins including secondary metabolites.